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Contribution submission to the conference Berlin 2015

The impact of carbides on the hydrogen trapping and embrittlement of Fe-C-X quenched and tempered alloys —
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The present work evaluates hydrogen trapping and embrittlement of different laboratory cast Fe-C-X alloys with various carbide forming elements (=X). Tempering generated X-based precipitates. The materials were examined under two conditions, as quenched and quenched and tempered. The hydrogen trapping capacity of the precipitates was investigated by thermal desorption spectroscopy, while melt extraction allowed to determine the hydrogen content after cathodic charging. In-situ hydrogen pre-charged tensile tests were performed to evaluate the hydrogen embrittlement susceptibility. The different carbides exhibited a variable effect on the hydrogen embrittlement behavior. For example, the Fe-C-Ti material embrittled the most and tempering even increased its susceptibility, whereas the opposite tendency was observed for the Fe-C-Cr grade. On the contrary, the resistance against embrittlement was good for all Fe-C-Mo alloys. Other carbide forming elements such as V, Nb and W were evaluated as well. All observations were correlated with thermal desorption spectroscopy and melt extraction results. It was also demonstrated that, by modifying the tempering treatment, the Ea of the traps could be increased and hence the HE-resistance of the material was improved.

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